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NUTRITION IN PUBLIC HEALTH
The Newfoundland Nutrition Survey

By RUTH WOODS

The phenomenal strides made in nutrition research throughout its relatively brief history are well known to those interested in this field. For the most part, the basic principles of nutrition have made the transition from the laboratory to clinical practice with comparative speed. Much of the practical application has been through the medium of medical science, largely as therapeutic measures in individual cases. In pediatrics, obstetrics and the newer specialty of geriatrics nutrition has fast assumed a special niche as part of so-called "standard practice." In surgery, intravenous feeding and other branches of medicine, the vital role of nutrition is well established, but the principles have not yet been universally incorporated into routine hospital procedure. The transfer of nutrition research findings to general public health measures has lagged even further behind.

Some advances have been made. In the United States and Great Britain, for example, compulsory food enrichment programs have been adopted (i.e., white flour, margarine). Although this is a small beginning, it has been found to be of the utmost public health significance. School lunch programs, provision of free milk to school children, enrichment of corn flour—a staple dietary item among the poor in the South—industrial nutrition campaigns are a few examples of other steps slowly being developed toward the elimination of widespread malnutrition and the attending evils of substandard health and impaired physical and mental efficiency. More attention is being given to controlled population surveys in scattered areas throughout the United States; scientific studies of the effects of war, food rationing and starvation have been made in Great Britain, Germany, countries of occupied Europe, in Russia during the siege of Leningrad, in Western Netherlands and in prison war camps throughout the world.

In Bataan, in the Philippines, a recent survey disclosed the deplorable fact that large numbers of deaths still occur annually from beriberi—a condition which cannot be condoned in the face of the fact that adequate thiamine in the diet, plus other B vitamins, can completely eliminate the disease. In these enlightened times frank beriberi, having a fatal outcome, should be a disease long since relegated to historical nutrition texts. Thanks to this survey, a major step in this direction is now being undertaken. Failing the conversion of public tastes to vitamin-rich brown or unpolished rice, government agencies have begun a universal enrichment program whereby essen-

tial nutrients are being restored to publicly acceptable polished, white rice. This is an example of a long-neglected public health measure the results of which may mean the difference between life and death among the Bataan populace—particularly among pregnant women, nursing mothers and newborn infants.

In Newfoundland, similar surveys some years back likewise revealed a condition of widespread malnutrition throughout all segments of the population. Remedial public health measures were immediately undertaken. After four years, a scientific resurvey was made with highly gratifying results. The following is the story of the Newfoundland study as an example of the role of modern nutrition in public health and welfare.

The Newfoundland Survey — 1945:

The geography of Newfoundland, its social and economic conditions have long been major contributory factors in the development of widespread malnutrition in this area.

Prior to 1949 Newfoundland was not part of Canada. Its status, from World War I until 1933, was like that of Canada, one of a self-governing Dominion of Great Britain. Because of financial difficulties, the government of Newfoundland relinquished its self-government temporarily in 1933 and was ruled by a Governor and Commission from Great Britain, with Great Britain assuming responsibility for the financial deficits. In 1948 Newfoundland voted to become a province of Canada. The results of the nutrition surveys, invited by the Newfoundland government in 1944, and of the resurveys in 1948 are now the consideration and responsibility of the Canadian Department of Health and Welfare.

Newfoundland is an island, slightly smaller in area than the state of New York, which lies in the Gulf of St. Lawrence, off the east coast of Canada. The principle occupation is fishing. As a result a large proportion of the population is distributed in some 1500 tiny settlements along the coast. These are known as the outports. Of the 320,000 population in 1944, approximately 60,000 were inhabitants of the outport capital, St. John's. Prior to the war of 1939-45, Newfoundland was off the beaten track, scarcely known to outsiders and almost completely out of contact with the rest of the world. With the war, as a result of trans-oceanic aviation, the island became a world crossroads and a strategic center of great military and peacetime significance. Thus, at the time of the most recent preliminary surveys (1944-45), the long-suffering economic status of Newfoundland was just beginning to show improvement.

Health Conditions in Newfoundland Prior to 1944:

The history of Newfoundland has been one of classic ill health and high mortality closely associated with malnutrition. Mortality rates are higher than in groups of comparable ancestry in other parts of Canada; the prevalence of tuberculosis is very high; infant mortality is two to three times that in the United States. A history of deficiency diseases dates back to 1912. At that time Little (1, 2) reported the high incidence of beriberi observed by Sir Wilfred Grenfell in Northern Newfoundland, as well as his own observation of many similar cases. Deficiency diseases, including not only beriberi, but scurvy, night blindness, and the like, as well as dental caries, tuberculosis and gastric disorders were reported by numerous investigators throughout the decade from 1920 to 1930 (3, 4, 5, 6, 7). Dietary surveys in 1929 and 1930 by Mitchell (6) and Vaughn and Mitchell (7) indicated that fresh vegetables were scarce and few families had milk. The calcium intake, where no milk was consumed, was very low—from 0.2 to 0.5 grams per day. This is in sharp contrast to the recommended daily allowance (8) of 1.0 gram per day for adults and ranging from 1.0 to 1.4 for children. The prevalence of hopelessly decayed and broken down teeth in the children was attributed (7) to the low calcium-phosphorus ratio (estimated to range from 1:2 to 1:5). Vaughn and Mitchell (7) also reported a very high incidence of rickets, beriberi and tuberculosis.

In 1941, Steven and Wald (9) reported a decrease in night blindness due to vitamin A deficiency. In 1944, however, continued prevalence of multiple deficiencies was revealed by a study of the vitamin status of a hospital population on the west coast of Newfoundland (10). Clinical examination and chemical tests on over 300 unselected patients revealed widespread vitamin C deficiency as well as signs of B complex deficiencies. These were attributed by the investigators to the widespread use of refined white flour, the preference for salt fish and salt meats, and the lack of green vegetables and milk. This study provoked marked concern with respect to the nutritional problems of Newfoundland and led to the two major surveys which are the subject of this review—one at Norris Point on the west coast and one among the various outports on the south and east coasts.

The East and South Coast Survey:

In 1944, the government of Newfoundland invited a nutrition survey of the island by a group of Canadian, British and American physicians. The group consisted of 10 investigators: Drs. Adamstone, Moore, Tice and Tisdall of Canada; Dr. Platt of Great Britain, and Drs. Jolliffe, Kruse, Lowry,

Sebrell and Wilder of the United States. This group conducted a detailed survey on 868 unselected persons from St. John and other eastern and southern outports. Their studies included clinical examinations; chemical analyses of blood and urine for vitamins, protein and phosphatase; and dietary investigations (11).

Survey Findings (Clinical): The clinical examination consisted of tests and inspection not only for changes which may result from food deficiencies but for other changes which, although related to malnutrition, may possibly be the result of other factors as well. (Table 1).

The authors point out that while it is generally recognized that most of these effects are produced by nutritional deficiency, there is also the possibility that non-nutritional causes may produce similar symptoms. However, correlating these findings with the results of diet surveys and chemical tests led the authors to conclude that nutritional deficiency was the prime causative factor.

From these manifestations,* it was concluded that nutritional deficiency diseases were quite widespread. Of all the deficiency states observed, those associated with a lack of vitamin A, riboflavin and ascorbic acid were most frequently encountered.

(Chemical Findings): With the possible exception of riboflavin, close correlation between chemical findings and clinical observations was obtained. This is of particular interest in view of the fact that chemical examination of the blood and urine can merely furnish information as to the recent dietary intake of the individual, whereas clinical examination may reveal evidence of past as well as present difficulties.

(Diet Analysis): The diet of the large majority of the inhabitants is monotonous. At the time of the survey, local production of food was limited to a few items and difficulties of transportation to the outports restricted the imported foods to the relatively unperishable staples. The major part of the food was imported, and since the quantities brought in were known (Table 2) it was possible to arrive at a reasonable estimate of the nutrients available.

Local food production comprised (1) a very small amount of meat and eggs (2 to 12 hens per family, one or two pigs in a small minority of families). The annual egg production was 4,200,000, supplemented by annual imports of 4,800,000, providing ½ egg per week per capita; (2) very small local production of milk due to lack of arable land for pasture; most

*cf. *Borden's Review of Nutrition Research,* February, 1945, "Diagnosing Nutritional Deficiencies."

Table 1. Prevalence of Signs of Malnutrition and Other Signs Possibly Related to Malnutrition (11)

	Out-ports	*St. John's*	*Total*
Number of persons examined	599	269	868
SIGNS OF MALNUTRITION	%	%	%
HAIR:			
Dry Staring	11.4	7.4	10.1
SKIN OF BODY AND LIMBS:			
Xerosis	4.3	0	3.0
Mild follicular changes	43.2	25.6	37.7
Follicular keratosis	6.2	1.1	4.6
Perifolliculosis	2.0	1.9	2.0
Crackled skin	2.7	0.4	1.9
SKIN OF FACE:			
Folliculosis	9.9	2.2	7.5
Dyssebacia	5.5	3.3	4.8
Suborbital pigmentation	15.3	19.4	16.5
Telangiectasis	13.6	4.5	10.7
EYES:			
Thickening of conjunctiva			
Grade 1	33.8	43.0	35.4
Grade 2	27.0	26.7	26.8
Grade 3	18.5	5.2	14.4
All grades	79.3	74.9	76.6
Hyperæmia—Grade 1	35.3	36.4	35.6
Grade 2 and greater	13.2	5.6	10.8
All grades	48.5	42.0	46.4
Blepharitis—Grade 1	20.0	13.2	18.0
Grade 2 and greater	7.3	4.1	6.3
All grades	27.3	17.3	24.3
Lachrymation	8.4	2.9	6.2
Photophobia	8.4	3.7	6.8
LIPS:			
Angular stomatitis	24.7	16.3	21.7
Cheilosos—Grade 1	41.0	45.1	42.15
Grade 2 and greater	32.6	11.5	26.2
All grades	73.6	56.6	68.35
TEETH:			
Malocclusion severe	19.4	21.2	20.0
Active caries severe	59.6	65.6	61.4
Loss of teeth—Moderate	16.7	27.2	20.1
Marked or complete	20.4	12.3	17.8
All grades	37.1	39.5	37.9
GUMS:			
Red hyperæmia—Grade 1	25.2	26.8	25.8
Grade 2 and greater	18.2	7.1	14.8
All grades	43.4	33.9	40.6
Blue congested	7.8	3.3	6.5
Swollen	46.1	42.0	45.2
Interdental papillæ lost	21.7	16.3	20.2
Recession	53.9	47.2	52.2
Retraction	25.9	14.9	22.6
Pus	14.4	8.9	12.7
TONGUE:			
Reddened	7.7	1.8	5.8
Magenta	10.9	8.9	10.2
Swollen	7.1	0.4	4.9
Hypertrophic papillæ tip	13.2	14.5	13.7
Hypertrophic papillæ—tip and elsewhere	19.3	24.9	21.1
Hypertrophic papillæ—all degrees	32.5	39.4	34.8
Atrophic papillæ tip	15.4	10.4	13.9
Atrophic papillæ—tip and elsewhere	21.0	12.6	18.4
Atrophic papillæ—all degrees	36.4	23.0	32.3
Fissuring severe multiple	11.2	4.8	9.2
BONES:			
Signs of rickets	2.6	2.6	2.6
MUSCLES:			
Poor development—winged scapulæ	9.6	12.6	10.5
NEUROLOGICAL SIGNS:			
Absent knee and ankle jerks	2.3	0.7	1.8
Loss of vibratory sense			
Toes	4.0	0.3	2.9
Malleoli	1.5	0	1.0
Tibiæ	0.8	0	0.6
Tender calf muscles	2.3	1.1	2.0
Squatting test positive	0.8	0.4	0.7

of the milk was used for coloring tea or to feed the livestock; imported milk (mainly canned, vitamin D evaporated) was wisely distributed mainly to children under a rationing system: five 14½ oz. cans per week up to one year of age, three cans per week up to two years, and two cans per week up to 5 years of age; (3) a large catch of fish, principally cod; the amount retained for local consumption averaging 3 oz. per person per day; (4) a

moderate yield of garden produce, mostly potatoes, cabbage and turnips; (5) almost no production of fats, oils or cereal grains.

Using estimates of production and the figures for imports (Table 2), it was possible to arrive at an estimation of the nutrients available per person per day (Table 3).

It appears from the data in these tables that the food available in Newfoundland was adequate in respect to calories and protein. The percentage of calories supplied by fat was sufficient for health but was less than the amount desired and consumed by people in the United States and Canada. The calcium available was inadequate, being only one-third to one-half the amount recommended.

The most severe deficiency was in the supply of ascorbic acid. The ascorbic acid content of Canadian potatoes varies from 30 mgm. per 100 grams in September to 10 to 15 mgm. in January and 5 to 10 mgm. in the late spring. Unfortunately, due to the custom of cooking all the potatoes for one day before the noon meal, there is a 100% loss of the ascorbic acid in the portion used in the supper meal. This combined with the loss of about 50% of the ascorbic acid in the boiling of potatoes means that about three-quarters of the ascorbic acid content of the potato is lost. Also, it is customary to boil cabbage one to two hours, which results in a loss of over 90% of its ascorbic acid content. The only other available food with an appreciable amount of ascorbic acid is turnips. These were only used about twice a week over a maximum of forty weeks. The amount of ascorbic acid actually eaten averaged less than 20 mgm. a day.

The amount of vitamin A in the available food supply was markedly below the recommended allowances, not exceeding 1,400 I.U., compared with the recommended allowance of 4,590 units. The riboflavin in the food is also very low.

A very large amount of flour was included in the food supply. The major portion was plain white flour. The supply of sugar and syrups was also high. The net result was a food supply which provided two-thirds of its calories, 67%, as carbohydrate, compared with 51% as carbohydrate in the food supply of both Canada and the United States for 1943. The relatively high percentage of carbohydrate in the food supply of Newfoundland tended to increase requirements for thiamine, which was already low compared with the recommended allowance.

The amount of niacin, 15 mgm., closely approximated the recommended allowance, 14.5 mgm.

Thus, compared with the recommended allowances the food supply was theoretically adequate in calories, protein and fat, but extremely low in

Table 2. Data on Imports and Estimates of Food Production, Newfoundland, Population 320,000, 1943 (11)

Item or class	*Imports*		*Production*	*Total pounds per capita*	
	Total pounds	*Pounds per capita*	*Pounds per capita*	*Newfoundland*	*Canada (2) (1943)*
1. Dairy products (total milk solids) *(3)*	2,155,000	6.7	9.1	15.8	64.3
2. Meats (edible)—includes poultry *(4)*	14,218,000	44.5	*(1)*	44.5	110.3
3. Fish and game *(5)*	*(1)*	*(1)*	71.0	71.0	26.2
4. Eggs *(6)*	640,000	2.0	1.8	3.8	37.8
5. Fats and oils *(7)*	13,176,000	41.1	*(1)*	41.1	43.6
6. Sugars and syrups *(8)*	28,833,000	90.0	*(1)*	90.0	79.1
7. Potatoes *(9)*	15,500,000	48.0	232.0	280.0	205.1
8. Pulses (peas and beans)	5,400,000	16.8	*(1)*	16.8	11.7
9. Tomatoes and citrus	*(1)*	*(1)*	*(1)*	*(1)*	61.5
10. Other fruit (fresh equivalent) *(10)*	13,450,000	42.0	*(9)*	42.0	72.4
11. Leafy green and yellow vegetables *(11)*	980,000	3.1	50.0	53.1	43.2
12. Other vegetables *(12)*	3,150,000	10.0	20.0	30.0	32.8
13. Grain products *(13)*	100,750,000	311.1	*(1)*	311.1	215.4

NOTES:

(1) Negligible amount.

(2) The Canadian estimates are those of "per capita supplies of food moving into civilian consumption, Canada, 1935-39 to 1943" made by Joint Committee of Combined Food Board.

(3) Imports: Evaporated milk 5,860,000 pounds, dry skim milk 36,000 pounds, cheese 723,440 pounds. Production estimated at 8,000 gallons fluid milk per day.

(4) Imports:Cattle for slaughter 3,240 at 390 pounds, or 1,263,000 pounds, fresh meat and poultry 2,400,000 pounds, smoked and canned meats, 2,555,000 pounds, bologna and sausage 2,000,000 pounds, salt meats 6,000,000 pounds, total 14,218,000 pounds.

(5) Imports of fish and game are negligible. Cod fish reserved for consumption in Newfoundland estimated in Report of Newfoundland Royal Commission, 1933 (Ref. 11) at 200,000 quintals (hundred weight). The population then was 282,000 [census of 1935 (Ref. 10)].

(6) Imports: Eggs 4,800,000 (640,000 pounds). Production eggs 4,200,000 (560,000 pounds).

(7) Imports: Lard 800,000 pounds, vegetable shortening 875,000 pounds, fat back pork 4,800,000, margarine 9,000,000 pounds, butter 327,000 pounds. Conversion factors, for lard 1.0, for vegetable shortening 1.0, for fat back pork 0.82, for margarine 0.81, for butter 0.81.

(8) Imports: Sugar 24,500,000 pounds, molasses 510,000 gallons, jams and jellies 253,000 pounds.

(9) Imports as shown: Local production large. Agricultural authorities suggest average consumption at about 280 pounds per head of population.

(10) Imports of fresh fruits from Canada unrestricted, but negligible in amount, also canned fruit 1,450,000, dried fruit 3,000,000. Local production limited to wild berries, negligible in amount. Conversion factors, for canned fruit 1.0, for dried fruit 4.0.

(11) Imports of canned vegetables 980,000 pounds. Fresh vegetables from Canada are unrestricted but amounts imported are small. Production limited to cabbage.

(12) Imports limited to onions, 3,150,000 pounds. Local production of vegetables is mainly restricted to potatoes, cabbage and turnips. A few carrots are grown, a little chard.

(13) Imports: Flour (white) 500,000 barrels (98,000,000 pounds), oatmeal and other breakfast cereals 1,750,000 pounds, rice 1,000,000 pounds.

Table 3. Nutrients Available for Civilian Consumption per Day, Newfoundland, 1943 (11)

Item	*Amt. per day*	*Calories*	*Protein*	*Fat*	*Carbohydrate*	*Calcium*	*Iron*	*Vitamin A*	*Ascorbic acid*	*Thiamine*	*Riboflavin*	*Niacin*
	oz.	*No.*	*gm.*	*gm.*	*gm.*	*mgm.*	*mgm.*	*I.U.*	*mgm.*	*mgm.*	*mgm.*	*mgm.*
Dairy products, as fluid milk	5.5	104	5.4	6.0	7.3	183	0.1	360	2.5	0.04	0.26	0.1
Meat, boneless	2.0	110	9.1	15.9	0.1	6	1.4	256	0.7	0.08 *(6)*	0.17	3.7
Fish	3.1	73 *(2)*	17.0	0.3	*(1)*	27	0.4	*(1)*	*(1)*	0.05	0.04	2.1
Eggs	0.2	7	0.5	0.5	*(1)*	2	0.1	42	*(1)*	*(1)*	0.02	*(1)*
Fats and oils	1.8	460	0.2	51.0	0.2	6	0.1	520	*(1)*	*(1)*	*(1)*	0.1
Sugars and syrups	3.9	450	*(1)*	0	112.0	22	*(1)*	*(1)*	*(1)*	*(1)*	0.01	*(1)*
Potatoes	12.3	250	6.4	0.4	63.9	23	1.8	136	29.2 *(5)*	0.26	0.15	3.4
Pulses (beans and peas)	0.7	74	4.8	1.3	11.9	23	0.6	3	*(1)*	0.10	0.08	0.7
Tomatoes and citrus	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
Other fruits	1.8	33	0.2	0.2	7.8	5	0.2	97	1.9	0.01	0.02	0.2
Leafy green and yellow vegetables (cabbage)	2.3	21	1.0	0.1	4.2	20	0.9	*(3)*	9.2 *(5)*	0.05	0.04	0.6
Other vegetables	1.3	15	0.5	0.1	3.2	8	0.1	28	4.5	0.01	0.02	0.1
Grain products	13.7	1,400	43.3	4.3	298.0	90	3.8	1	*(1)*	0.30 *(6)*	0.22	4.0
Total, all sources		2,997	88.4	80.1	508.6	415	9.5 *(4)*	1,443	48.0 *(5)*	0.90 *(6)*	1.03 *(7)*	15.0 *(8)*
Canada (1943) *(9)*		3,223	97.2	133.2	408.9	956	16.4	6,783	61.2	2.02	2.09	18.6
Recommended National Research Council *(10)*		2,544	66.1			960	11.8	4,590	71.3	1.45	2.10	14.5

NOTES:

(1) Negligible amount.

(2) Based on figures for dry cod of the Canadian Council on Nutrition. The values for "fish and game" of the Joint Committee are inapplicable in this instance, since there is little game and the fish is mostly dry cod.

(3) Almost no vitamin A in the cabbage as prepared.

(4) Use of enriched flour will add 5 mgm. to this total.

(5) This is a gross over-estimate if applied to consumption for Newfoundland, where potatoes are boiled in the morning, which causes a loss of about 50% of their ascorbic acid, and in part held over until the evening meal, which results in nearly total loss of ascorbic acid. The cabbage is boiled one to two hours with a loss of 90% of its ascorbic acid. The actual intake of ascorbic acid probably does not average more than 20 mgm. a day.

(6) The figures for thiamine for meat and grain products, using the values of the Joint Committee, would be 0.38 and 0.61 respectively. These values are inapplicable in these instances because in Newfoundland the meat is mostly beef, much of it dried, and 80% of the flour used is white patent flour. Use of enriched flour will add 1.4 mgm. of thiamine to the present total, raising the estimate from 0.90 to 2.30 mgm.

(7) This very low figure will be raised to 1.83 mgm. by use of enriched flour.

(8) Use of enriched flour will add 9 mgm. to this total.

(9) The Canadian estimates are those of the Joint Committee of the Combined Food Board (Table 42).

(10) Weighted recommended allowance per capita (calculated for Canada by application of population statistics to table of Recommended Allowances of Food and Nutrition Board, U. S. National Research Council) from Report of Joint Committee of the Combined Food Board (Table 31).

vitamin A, riboflavin and ascorbic acid. This was in close agreement with the clinical and chemical findings. Thiamine was in better supply, but still inadequate; niacin was at the recommended level. Iron was somewhat below and calcium extremely below the recommended levels. The authors emphasize that these are average figures, that few ate such average amounts, but undoubtedly consumed less.

Norris Point Survey:

Almost simultaneously with the survey by Adamstone and collaborators in St. Johns and nearby outports, another group of Canadian and American researchers were cooperating in a similar study at Norris Point on the west coast of Newfoundland (12). This study was a follow-up of the previous investigation by the Canadian members of the group shortly before (10). It differed in purpose from the studies of Adamstone *et al* in that specially selected subjects were chosen rather than a random sampling. The population sample was selected from groups known to be particularly susceptible to nutritional deficiency, i.e. recently pregnant and lactating women and rapidly growing children. Such groups were considered as a sample so weighted as to uncover nutritional deficiency if it existed. The sample was not representative of the general nutrition of the community, but rather of the poorest nutrition. It was felt that if these groups, under physiological stress, showed no evidence of malnutrition, no great amount of malnutrition would be present in the population at large.

The family was made the unit of study and only those in which there had been a pregnancy within the last two years were included. In addition to the women of such families, children between the ages of 3-6 and 10 and 14 were studied; other children were excluded. Husbands were studied when available, but were often absent in fishing or lumbering industries. Thirty-nine families comprising 113 subjects, or about 40% of the population of the village, were included.

The examination included:

1. A detailed nutrition history (food intake record).
2. A complete medical history.
3. A thorough physical examination.
4. Photographs of all lesions and of children against a standard measuring scale.
5. Laboratory tests of blood and urine.

The purpose of the survey was twofold: (1) rapid assessment of nutritional status by examination of a weighted population sample; (2) estab-

lishment of a baseline from which the future nutrition of the same or similar samples could be judged. It was particularly desirable to establish this baseline for beginning the following month all flour entering Newfoundland was to be enriched to American standards with thiamine, niacin and iron.

Nutrition Findings: Diets of all the families were very similar. Children, after weaning, received the same food as adults (Table 4).

Table 4. Typical Daily Menu

Breakfast	*Dinner*	*Supper*
Porridge with milk (30-40 ml.) and sugar or molasses	Fish (salt or fresh), fried or boiled Potatoes	Same as noon meal—leftovers repeated
or	or	Bread, biscuits or cake
Baked beans Bread with margarine, jam or molasses Tea	Hash (salt meat and potato)	Tea
	or	*Occasional Foods*
Between Meals (Two or three times Daily)	Thick soup (stew)	Eggs, 2 or 3 times weekly Dried peas, cooked tomatoes with macaroni, once weekly
Bread, biscuits, jam, cake, or cookies	or	Evaporated milk (1 to 2 tsp.) in tea
Tea	Boiled dinner (potatoes and turnips; occasionally cabbage and carrots; salt or fresh meat if available)	
	Bread with margarine, jam or molasses Tea	

The food supply and over-long cooking methods were nearly identical with those reported in the survey of the east and south coast towns (11). A rough approximation of the nutrient intake was made from the diet history and did not include losses due to improper cooking methods (Table 5).

Clinical and Laboratory Findings: The clinical symptoms and physical signs suggestive of vitamin deficiency were strikingly similar to those reported by Adamstone *et al* (11) in their survey of 868 unselected persons, and will not be repeated here. Multiple deficiencies were common. Those most frequently encountered were Vitamin A, riboflavin and iron deficiencies among the women and children; vitamin A and riboflavin deficiencies in the men. Marked dental caries was found in nearly half the women, and in nearly one-third of the children and men. Twenty percent of the children had evidence of past rickets. This seems to be no less than astounding in a region where cod is the main "crop" and an unlimited supply of cod liver oil was to be had.

Table 5. Nutrient Intake Estimated From Diet History

	Family Calories		Protein gms.	Calcium gms.	Iron mg.	Vit. A I. U.	Vit. C mg.	Thiamine mg.	Ribo-flavin mg.	Niacin mg.
Adult Women	27	2000	69	0.4	11	1,300	41	0.8	0.9	11
	30	2200	64	0.6	10	1,600	35	0.9	1.1	8
Children 10-14 yrs.	28	1600	51	0.3	6	600	18	0.5	0.7	7
	23	1800	52	0.4	11	2,000	41	1.1	1.0	10
Children 3-6 yrs.	30	1400	42	0.6	6	1,200	26	0.6	1.1	5
	12	1300	42	0.3	4	700	6	0.4	0.7	4

The Newfoundland Nutrition Goal:

The long history of poor health and deficiency diseases in Newfoundland received dramatic confirmation and reemphasis through the scientifically planned population studies described in this report. As a result it became obvious that an equally scientifically planned nutrition program was urgently needed for the population of Newfoundland. It would be by this means only that years of ill health and impaired efficiency could eventually be wiped out and the populace raised to a level of buoyant health and maximum productivity.

A review of the recent findings demonstrated that the most serious nutritional deficiencies prevailing in Newfoundland were those of calcium, riboflavin, vitamin A and ascorbic acid.

Remedial Measures: A number of suggestions for remedial measures immediately presented themselves. One of the first of these was the program for the enrichment of bread and the increased enrichment of margarine. Other measures would depend almost exclusively on slow but determined education of the people as to the importance of proper diet, proper cooking methods, improved gardening and food preservation methods and the development of more crops especially adapted to grow in the poor soil characteristic of Newfoundland.

At least three immediate changes would seem indicated:

(1) A recommended increase in the consumption of milk by adults as well as children. This would immediately raise the calcium, phosphorus and riboflavin levels toward the desired goals. It would also help offset the deficiency of vitamin A.

(2) To further remedy the vitamin A shortage, further enrichment of margarine. In addition, recommendation for the more widespread use of locally produced

cod liver oil (rarely used by the natives) to insure adequate vitamin A intake, as well as the required amount of vitamin D for children.

(3) Conservation of the vitamin C content of potatoes, cabbage and turnip (the chief local sources of this vitamin) by proper methods of preparation and cooking.

The actual steps undertaken by the Newfoundland government and by participating nutrition and medical authorities will be detailed in the forthcoming issue of Borden's Review of Nutrition Research. The results of these measures, after a period of four years, as determined by a nutrition resurvey will be outlined as well. An analysis of these facts makes it possible to establish the significance of the Newfoundland experiment in terms of what it may mean to similar population groups and to world nutrition and public health in general.

ERRATUM

On page 7 line 11, of the January, 1950 issue of Borden's Review of Nutrition Research, "Nutrition Highlights — 1949," the sentence "The vitamin is given via injection in 1 mg. doses . . . ." should read, "The vitamin is given via injection in one gram doses . . . ."

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